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guest editorial

Oxygen-carrying resuscitation solutions

Two important functions of blood are represented by the ability of red cells to reversibly bind and transport oxygen to the tissues and the ability of plasma proteins to maintain oncotic pressure. Because blood is a limited and valuable resource and has a relatively short storage life, several investigators have been attracted for many years to the development and evaluation of oxygen-carrying resuscitation solutions which could fulfill the functions of blood when administered for fluid-replacement therapy. Significant progress in these studies has been achieved in recent years. Investigative efforts have been intensified in view of several reports demonstrating that oxygen-carrying resuscitation solutions, used in essentially complete replacement of blood, can maintain life. Adverse biological effects, observed in earlier studies, have been addressed by several investigators, with the objective of obtaining safe and effective products. These activities have led to substantial improvements in the quality and purity of experimental oxygen-carrying resuscitation solutions. A clearer understanding has been achieved concerning the capabilities and the limitations of the products currently available. This clearer picture has allowed delineation of those manipulations necessary to modify the present resuscitation solutions for systematic improvements. New and better products have been developed recently and are currently being evaluated in experimental animals.

The development of effective oxygen-carrying resuscitation solutions may have an impact on both military and civilian blood-banking practices. This impact could be critical due to increased blood use and demand for aggressive surgical procedures, and to greater concern with the possibilities of mass casualties in civilian disasters or military conflicts. The acceptability of oxygen-carrying resuscitation solutions will be determined by cost considerations and the relative risk-benefit ratios compared to using the traditional banked blood and blood components. Resuscitation solutions could overcome immunological and viral hazards connected with the administration of blood and may improve the microcirculation in vital organ systems by decreasing the hematocrit, i.e. lowering the viscosity of the circulating fluid.

Many potential applications of the oxygen-carrying resuscitation solutions may have a significant effect in biology and medicine. Presently, due to chronic shortage of blood, elective surgery is postponed and surgical schedules in many large hospitals are planned in relation to expected or actual blood supply. Future research will determine the practical success of potential applications of resuscitation solutions. Results to date have been encouraging and have shown that the proper preparations can be used to advantage in ways not thought to be possible a short time ago. Alternatives to blood are needed, not only to conserve a valuable resource but also to furnish a wider base for both practical and experimental purposes.

Because oxygen-carrying resuscitation solutions can fill critical needs and have enormous potential, rigorous specifications are being formulated for their effectiveness and safety. It is important to establish a long-range program. As standardized materials and furnished products become available to interested investigators, more meaningful comparisons will be possible among the studies originating from different laboratories. Achieving optimal resuscitation solutions with effectiveness and safety features is of particular interest, especially in view of the fact that the question of blood substitutes has been considered in an expanded national discussion about blood and blood supply in the United States.

It is hoped that the concerted and intensified efforts of interested investigators will soon result in resuscitation solutions which will fulfill the important functions of blood and which will elicit no permanently adverse effects when administered for fluid replacement therapy in critically ill patients.

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